Vol.VII No.5 May 1978 Monthly except during July and August Price $5.50 yearly Single Issue 75¢ Publisher, Jim Cranshaw

Second-class postage paid at Dallas, Texas Office Address: 9820 Silver Meadow Drive, Dallas, Texas 75217 214-286-1673

THE NEWSPAPER FOR
THE HOBBYIST OF VINTAGE
ELECTRONICS AND SOUND

THE HORN SPEAKER

Radio News for September, 1926

Television An Accomplished Fact

By A. DINSDALE

This authorized description of the television apparatus invented by J. L. Baird will be of the greatest interest to those who wish to keep abreast of radio's latest developments.

FOR the last twenty years the editor has published from time to time, various articles on Television, beginning first in MODERN ELECTRICS in 1908, and during the past few years through RADIO NEWS.

All these articles were of a theoretical nature, as Television was not at that time an accomplished fact. The editor came in for a good deal of criticism and was termed visionary on account of these articles.

Our faith in Television, however, was sufficiently persistent; and we believe that we will not be contradicted if we say that RADIO NEWS, in connection with its associated magazines, has published more articles on Television than any other agency.

And now, Television is an accomplished fact. The art has progressed to such an extent that it is possible to see a moving face at a distance and to actually, visually, witness a thing that takes place at a distance. This is true Television. The editors themselves were skeptical when they first heard about the Baird Television Apparatus and commissioned Mr. Dinsdale, who is a member of the Radio Society of Great Britain, to get the actual facts on it, which we now publish in an authoritative form.

Without trying to be over-enthusiastic or visionary, we wish to say now that Television will change our entire mode of living just as the Telephone, the Telegraph, and the Railroad changed our lives when they came into general use.

FOR some years past we have beocme accustomed to "listening in" by radio to audible sounds produced at some distant point, which may be anywhere up to several thousands of miles away. How long will it be before we are able also to "see in" by radio, and thus witness scenes and events at places similarly distant from us? In view of the vast progress recently made in this direction, the writer ventures to express the opinion that it will not now be very long before this comes to pass.

The cinematograph has been developed within the last twenty years or so, till today it is a highly-efficient and marvelous means of entertainment; but it is one-sided. Its appeal is to the eye only. We see a great actress speak, but we cannot hear her words. Many inventors have been working for years to make this possible, but it is not yet a commercial accomplishment.

As with the cinematograph, so with broadcasting as we know it to-day. We can hear a great man speak, but we cannot see his gestures and facial expressions. It is the province of Television to overcome this disability. By combining television with ordinary broadcasting, we shall, in the near future, not only hear the performance of a play, but also see the actors, the scenery, the entire stage.

REPRODUCTION OF SIGHT

That is the function of television. It must not be confused with telephotography, which is something totally different. Telephotography, or phototelegraphy as it is sometimes called, means the telegraphic transmission of a single "still" picture from one place to another.

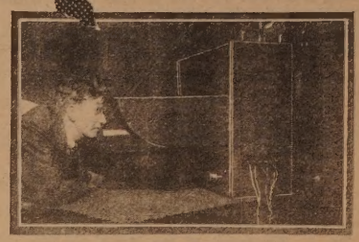
In Webster's dictionary television is confused with phototelegraphy, and if such an authority is in confusion, there is no wonder that the public—even the technical section of it—does not possess clear ideas on the subject. It needs no apology, therefore, to commence an article on television with an attempt to define exactly what television is, and for an authoritative statement, we cannot do better thon quote the British patent office, whose business it is to define and catalogue such terms.

In the patent office library we find classed, under the heading "Television," "Apparatus for transmitting instantaneously to a distance images of views, scenes or objects by telegraphy (either wire or wireless.)" In other words, Television means seeing at a distance by telegraphy.

Until recently, our only means of extending our range of vision beyond normal distances was the telescope; and the range of this instrument is distinctly limited. The development of television will enable us to see scenes and objects at distances as great as those over which we are now accustomed to communicate telegraphically and telephonically.

Capt. O. G. Hutchinson, president of Television, Ltd., is shown at the left; while above is an unretouched photograph of Mr. Hutchinson's image taken at the receiving screen of Mr. Baird's television apparatus.
© *International Newsreel.*

Mr. Baird demonstrating the receiver of his television apparatus, seen in the circle.
© *London News Agency.*



Mr. Baird "seeing-in" on one of his experimental televisors.

HISTORY OF DEVELOPMENT

Both phototelegraphy and television are no new ideas. The latter is but a development of the former; and the inspirations for both date back to 1873, when May, one of Willoughby Graham's assistants, communicated to the Society of Telegraph Engineers the details of his discovery of the photo-electric properties of selenium.

It was not long before this discovery led to the construction of selenium cells by Siemens, Graham, Bell and others. These, as all the world knows, are devices for transforming light impulses into electrical impulses; and the idea soon occurred to a number of investigators that they might be utilized to give to the eye what telephony had given to the ear, and render it possible to see by telegraph.

Ayrton and Perry, Senlee and several others actually described systems which were to accomplish this; and nearly fifty years ago it was confidently predicted that in a very short time it would be possible for us to see one another over the telephone line!

These optimistic inventors had, however, entirely overrated the capabilities of selenium to respond to the immense speed of signalling involved; and their predictions came to nought, as far as practical results were concerned. Considerable progress was made in phototelegraphy, however; for time is a secondary consideration in the transmission of a single still picture, and the various other problems in connection with this accomplishment are considerably easier of solution.

At the present time many investigators in various countries have demonstrated their ability to transmit and receive still pictures, either by wire or radio; among whom may be mentioned C. Francis Jenkins in the United States, Thornton Baker in England, Fournier and Belin in France, and Dr. Korn in Germany. Also worthy of mention is the more recent achievement of Captain Ranger of the R. C. A., who succeeded in sending a photographic copy of a check from London to New York in 25 minutes.

Phototelegraphy, therefore, is not only a definitely accomplished fact; it is also a commercial proposition. Television, however, has not made anything like such progress; for only one inventor has so far succeeded in giving an actual demonstration of "seeing at a distance."

SOME PROBLEMS OF TELEVISION

Most of the systems in use for transmitting still pictures make use of the cylinder method; in which the picture to be transmitted is transferred to a film; which is wrapped round a cylinder of glass. As this cylinder is rotated, a spot of light is caused to cover the film from end to end in a series of finely separated lines. The intensity of the light which passes through the film depends upon the latter's density at different points; and the varying light beam, after passing through the film, is focused upon a light-sensitive cell, of one or another type. This cell transforms the light variations into electric-current variations, which are sent over a wire or by radio to the distant receiver.

At the receiving end the process is reversed, the incoming current variations being caused to vary a source of light which is focused upon a photographic film wrapped around a rotating cylinder. This film becomes covered with fine lines of varying density, which, when developed in the usual manner, make up the complete picture.

Obviously, this system is inapplicable to television, for a scene, or even the image of it, cannot be wrapped around a cylinder. Some means, therefore, had to be found which would enable a picture to be transmitted directly from a flat surface. This can be done by moving the light beam instead of the picture. By rotating a suitably-designed and arranged series of prisms between a fixed light source, and a fixed flat-surface picture, the beam of light is made to traverse the picture from side to side, moving slowly across it as it does so, so that ultimately the entire surface is covered.

This, very roughly, is the operating principle of television apparatus, but only as applied to the transmission of a single picture or image.

From the transmission of a single picture from a flat surface to television is a far cry, however; and, to understand something of the tremendous obstacles to be overcome, let us consider the cinematograph. When witnessing a movie performance, we think we see a smoothly flowing animated scene. Actually, we are looking at 16 separate and distinct pictures every second, but, owing to the persistence of human vision, we do not receive this impression from the sense of sight.

The one and only similarity between the movies and television is that, in both cases, the scenes are projected upon a screen. In order to make television a success, it is necessary to transmit and receive something like 16 complete pictures per second, in order to give the witnesses an impression of lifelike movement.

THE BAIRD SYSTEM

The most successful inventor of apparatus for the achievement of television is John L. Baird, a young Scottish engineer. He is 35 years of age, and the son of a Presbyterian minister at present living in Edinburgh. After studying at the Royal Technical College, Glasgow, Mr. Baird "served his time" as an engineer at a motor works near Glasgow; after which, in 1912, he commenced his experiments in television. Faced with many

difficulties, he persevered until, in 1923, he succeeded for the first time in sending shadows which were flickering and coarse in outline, but unmistakable. About a year later he was successful in transmitting the image of objects by light reflected from them; and so he progressed until, early in this year, he was able to transmit a recognizable image of a human face, and demonstrated his invention before the Royal Institute, one of England's leading scientific societies.

The apparatus used by Mr. Baird to attain these results may be described as follows:

At the transmitting end, a battery of powerful lights shine upon the scene to be transmitted. Light reflected from this scene is collected by means of a lens, in much the same fashion as a camera lens collects the light reflected from a scene to be photographed. In the television transmitter, however, instead of a sensitive photographic plate, as in a camera, the reflected light is focused upon a light-sensitive cell.

Between the focusing lens and the cell, however, there are interposed two rapidly revolving discs. One of these discs has a number of lenses mounted upon its face in spiral fashion, as shown in Fig. 1. The function of these lenses is to cause the image of the transmitted scene to sweep across the light-sensitive cell in such a manner that the image is divided into fine parallel lines. The rotation of the disc gives the horizontal motion (*i.e.*, draws the lines), while the movement into focus of the next lens (set a trifle nearer the center of the discs) gives the necessary vertical motion to ensure that the lines do not over-lap. Reference to Fig. 1 will assist the reader to understand the action.

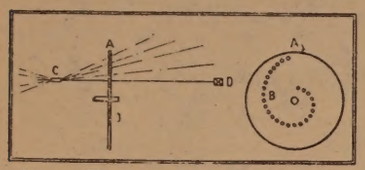


Fig. 1. The action of the Baird television transmitter: A is a rotating disc carrying spirally-arranged lenses, B, through which shines light reflected from scene, and collected by lens C. Movement of disc causes light beam to traverse light-sensitive cell D in two directions, horizontal and vertical.

In this manner the entire image is flashed across the light-sensitive cell in the space of one-tenth of a second. The light reflected from the high lights of the scene to be transmitted is, of course, very bright, while that reflected from the dim shadows of the scene is very dim. The light-sensitive cell transforms these light variations into electric-current variations, which are then amplified and transmitted over the circuit to the distant receiver.

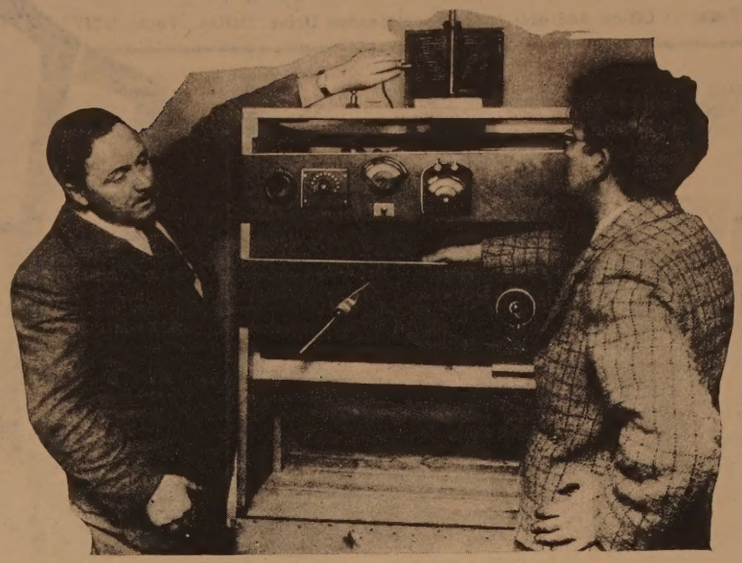
SPEEDING UP THE TRANSMITTER

The second disc referred to above is a serrated one, and its purpose is simply to interrupt the light at high frequency. By this means Mr. Baird found it possible to eliminate the inertia of selenium, and cause it to respond at a speed great enough to enable him to transmit a sufficiently large number, of complete pictures per second, to give to the observer at the receiving station the effect of a smoothly-animated scene.

Another advantage of interrupting the source of light is that the output of the light-sensitive cell takes the form of a unidirectional current, interrupted at high frequency, instead of a fluctuating D.C. as would otherwise be the case. A steady D.C. cannot be amplified by ordinary vacuum-tube amplifiers, whereas interrupted D.C. can. As the output current of a light-sensitive cell is extremely feeble, such amplification is necessary before transmission over a wire or wireless circuit can be accomplished successfully.

At the receiving end of the circuit Mr. Baird uses apparatus which, though similar in essentials to that used at the transmitting end, has been reduced to the simplest possible form. There is a source of light and a ground glass screen, and between the two rotate discs similar to those used at the sending station. The incoming current impulses are caused to vary the intensity, or brilliancy, of the light source, in accordance with the strong and weak currents delivered by the light-sensitive cell at the transmitter.

The rotating-lens disc then breaks up the beam of light and throws it on the screen as a complete moving picture. The discs at the transmitting and receiving stations are in each case driven by electric motors, and in order to achieve success, it is necessary that the motors at all receiving stations shall be in exact synchronism with the transmitting motor. This is accomplished in the Baird system by transmitting, in addition to the picture impulses, a low-frequency alternating current, by means of which all motors are kept in step.



Capt. Hutchinson and Mr. Baird discussing part of the latter's television apparatus.
© International Newsreel.

AN ACTUAL DEMONSTRATION

Having dealt so far with the nature and general problems of television, and outlined roughly the methods used by Mr. Baird to achieve it, let us now turn to his actual accomplishments.

While in London recently, the writer was privileged to witness a demonstration of Mr. Baird's apparatus in working order. The great inventor was much interested to learn that readers of RADIO NEWS were anxious to learn something about his work; and readily acceded to the writer's request for a demonstration.

Leading the way to the transmitting room, Mr. Baird moved over several switches. Behind a light-proof partition, where were located the revolving discs and the light-sensitive cell, a motor could be heard to start up. In the center of the partition was the large collecting lens, around which were mounted a battery of powerful lights, screened from the lens by means of reflectors which concentrated the light upon the scene to be transmitted.

Next, Mr. Baird marshalled before me several members of his office force, and told me to take a good look at them so that I should be able to recognise them again. This done, Mr. Baird led the way downstairs to the receiving room on the next floor, and seated me before the "Televisor," as he calls his receiving apparatus. Before me was a wooden cabinet, in the middle of which was a screen. Mr. Baird threw over some switches, made some adjustments, and then switched out the light, leaving the room in total darkness except for a flickering sepia-colored light on the screen.

Picking up a microphone, Mr. Baird instructed one of his assistants to seat himself before the transmitter. The reply came back through a loud speaker, and immediately an image appeared upon the screen.

There was no mistaking it. It was the head and shoulders of one of the men I had just seen upstairs. True, the image was flickering somewhat, and looked rather out of focus. The best description I can give of it is to compare it with the earliest forms of cinematograph. Nevertheless, the image was there, in smooth gradations of light and shade, bright high lights, dark shadows, and half tones, and perfectly recognizable beyond all question or doubt.

Mr. Baird then handed me the microphone and suggested that I should ask the sitter to perform various actions. I did so, and before my eyes the image moved, the eyes and mouth opened and closed, a hand rubbed the chin, and so on, exactly in accordance with my telephonic requests to the transmitting room.

As a final acid test, I requested the sitter to repeat certain words into the microphone at his end. He did so, and as these words issued from the loud speaker in the receiving room, I was able to follow distinctly the movements of the speaker's lips on the screen of the Televisor.

The other members of the staff whom I had seen came before the transmitter in turn, and I was able to recognize each one without difficulty.

TRANSMISSION PROBLEMS

During the above demonstration, transmission from the one room to the other was effected over a wire circuit, and Mr. Baird explained that the question of distance is an entirely minor problem of an ordinary telephonic character. Given any circuit, wire or wireless, however long, which will convey intelligible speech, Mr. Baird states that he can transmit television over it. He has already accomplished this by wire and radio over varying distances in England.

If the transmitted impulses are listened to, two sounds are heard. One is a low note, like that of a trombone, caused by the synchronising current, and the other a high note, similar to a piccolo's, caused by the rapidly-interrupted picture impulses. Asked if these transmitted impulses could be made inaudible, so that one carrier wave could be utilized to convey the words of a speaker, in the usual broadcast fashion, and also television impulses which would render the speaker visible to his audience, Mr. Baird replied that this is perfectly feasible. To accomplish this would simply mean raising the frequency of the transmitted impulses to a frequency band above the audible limit. Mutual interference can, in such a case, be prevented by means of suitable filter circuits.

In actual fact, Mr. Baird has been aiming to do just this—utilize the carrier wave of a single broadcasting station to broadcast not only the usual programs, but also a continuously-animated picture of what is occurring in the studio at the transmitting station. In other words, just as we now *hear* what is happening before the microphone, Mr. Baird intends that we shall soon be able to *see* what is happpening as well.

With this end in view, the inventor has devoted considerable thought to the simplification of the Televisor, or receiver. His aim has been to make it a piece of apparatus no more complicated than a loud speaker, which can be attached to the output terminals of an ordinary broadcast receiver, just as the loud speaker is, and in addition to it. This aim he has already achieved, and he is at present devoting all his energies to the further improvement of the transmitting apparatus which is progressing rapidly.

EFFECTS OF INTERFERENCE

In television, as at present demonstrated, the received image is liable to electrical distortion if not properly adjusted; and its effects are almost as distressing as distortion in a loud speaker, only that, instead of the music, it is the image which suffers. The image or face may appear flattened out as in a concave mirror, or a twisted effect may be produced, so that the face seen on the screen may have a flattened nose and a chin higher on one side than the other.

Fortunately distortion in the televisor is easily remedied, much more so than with a loud speaker. Adjustment is rendered easier as each effect can be *seen*, and the eye is a more reliable measuring instrument than the ear.

Interference takes many shapes. The whoops and whistles, which frequently mar radio reception, appear on the televisor screen as small snowstorms—a mass of whirling white flakes passing across the screen—while interference caused by electric light mains appears as a series of white bands moving up and down across the image. Static appears in the form of sudden white flashes.

The interference troubles inflicted upon ordinary B.C.L.'s. are not nearly so distressing when *seen*. A white flash passing over a screen is not nearly so upsetting and jarring to the nerves as a piercing whistle or a crash of static in the midst of a musical selection.

COMMERCIAL EXPLOITATION

Mr. Baird has now formed a company called Television, Limited, for the purpose of exploiting his great invention; and rapid strides are daily being made towards the commercial application of his apparatus.

So many claims have been made from time to time that the problem of television has been solved, that perhaps the public and the scientific world are apt to look askance at any television claim. There is, however, a very big difference between a claim and a demonstration.

Mr. Baird has actually demonstrated the transmission by Television of an image of the living human face, with gradation of light and shade, all movements being faithfully portrayed. True, the results are far from perfect. This, however, is beside the point; which is that Mr. Baird has definitely and indisputably given a demonstration of real television in the presence, not only of the present writer, but also, on other occasions, to representatives of the British press; and it is the first time in history that this has been done in any part of the world.

1926 AD

THE TUBE WITH THE SENSIBLE GUARANTEE

The Dam Support!

Vibrationless Uniform and Good

The construction of a dam is no better than its supports—they are equally important.

There are three elements in a radio tube. The slightest movement in relation to each other causes a characteristic change, invariably disqualifying the tube.

THE NEW SUPERTRONS HAVE SUPPORTS THAT TIE THE THREE ELEMENTS INTO ONE UNIT

The Base and Supports are ISOLANTITE

All types at public demand prices

SX 01 A	$2.00
SX 99	2.25
SV 99 small	2.25
SV 99 large	2.25
SX 12 (Power)	5.00
SX 20 (Power)	2.50
SX HiMu	3.00
Supertheon Half	4.00
Supertheon Full	5.00

In Canada slightly higher.

Full Details on Request

SUPERTRON MFG. CO. Inc.
HOBOKEN, NEW JERSEY
Chicago Office 30 N. Dearborn Street
Export Dep't, 220 Broadway, N. Y. C.

SUPERTRON
A SERIAL NUMBERED GUARANTEE
The Foremost Independent Tube in America

Electrical Tests on Horn-Type Magnetic Speakers.

Although the popularity of magnetic speakers has dwindled greatly and they have not been employed in recent receivers to any extent, many thousands of them are still in use in old receivers. Service men are often called upon to service them. There are two general types of magnetic speakers used with radio receivers. The first is the type which employs a diaphragm and a horn; the second is the type which employs an iron

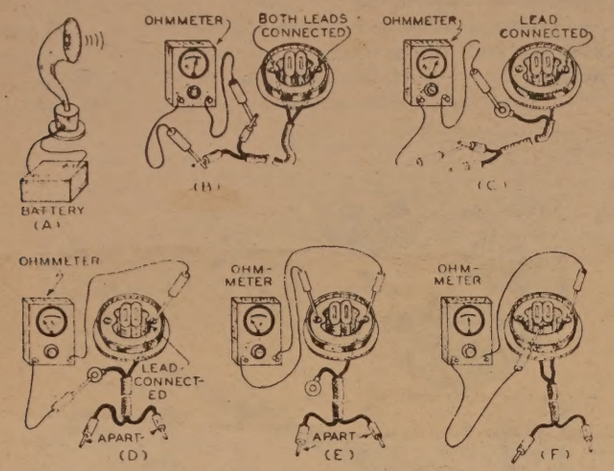


FIG. 26-8.—Various electrical tests which should be made on a magnetic loud speaker of either the *iron-diaphragm* or *balanced armature* type in order to locate electrical trouble in either the speaker cord or the coils. These tests are described in detail in the accompanying text.

reed or armature actuating a cone. Both types will be considered, separately, here.

Horn-type magnetic speakers are no longer in general use in radio receivers, and, where they are encountered with major troubles, it is usually best to replace them with one of the magnetic cone speakers which can now be obtained at low cost. However, the service man often encounters large horn-type speakers employing iron-diaphragm type units in public-address systems of small size. At any rate, it is well to know how to test and repair this type of speaker if the occasion arises.

A quick test to determine if the speaker operates at all may be made by simply touching the cord tips of the speaker across some source of low voltage as shown at (*A*) of Fig. 26-8. A *sharp* "click" should be heard each time this is done, if the speaker operates. If only a slight click is heard, the winding may be open, for a small current can flow due to the capacity between the two parts of the winding (which consists of many turns of fine wire).

If the speaker does not operate at all, the trouble is most likely an electrical one in either the speaker cord or the coils.

The cord should be tested first. Test for continuity across the tips of the speaker cord, as shown at (*B*). A constant deflection of the ohmmeter needle should result if the speaker winding is good. Bend the loud speaker cord back and forth at the tips; if the meter reader varies, it indicates a faulty connection at the tips. The connection should either be resoldered or, better still, the entire cord should be replaced with a new one. If no reading is obtained on the first test, open the case of the unit and remove the diaphragm and washers. Then remove one lead of the cord from the speaker unit. The ohmmeter should indicate a complete circuit from one of the cord tips to one of the lugs at the speaker end of the cord, as shown at (*C*). Repeat this test from the second tip to the second lug.

With one lug still disconnected from the unit, test for continuity across both lugs at the speaker end of the cord as at (*D*), making sure that the tips on the other end of the speaker cord are not touching each other. No complete circuit should be indicated; if a complete circuit is indicated, it shows that the two cord leads are shorted inside the covering. With one speaker cord lug still disconnected from the unit, test both unit terminals for continuity, as shown at (*E*). An "open" indication obtained here points to an open circuit somewhere in one of the magnet coils, or possibly in the leads to the terminals on the unit. These leads should be inspected carefully, for the thin wire often breaks, or corrodes away at the soldered joint. A break here can easily be resoldered. If resoldering is necessary, be careful to scrape away the enamel insulation and use rosin-core solder *only*. Never use "acid" or soldering paste fluxes as they will corrode the fine wire. If the ohmmeter shows a continuous circuit when the coil test is made, but shows that the coil resistance is extremely low, there is a "short" or "ground" within either or both of the coils. The next test will indicate which one is faulty.

As shown at (*F*), *each winding* should now be tested *separately* between its terminals, and between each terminal and the case of the unit. If a winding is found to have an internal short, open, or ground, it should be replaced. Each winding should have approximately the same resistance.

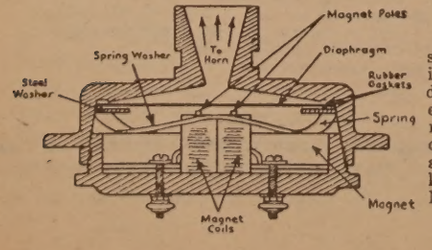
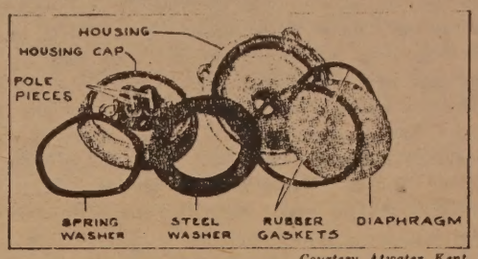


FIG. 26-9. — Cross-section view of a typical horn-type iron-diaphragm loud speaker unit, showing the relative arrangement of its parts. A disassembled unit of this kind is illustrated in Fig. 26-10.



Courtesy Atwater Kent Radio Co.

FIG. 26-10.—A typical iron-diaphragm type loud speaker unit disassembled to show its various parts.

This completes all the electrical tests that may be made on magnetic units. As we shall see in Art. 26-17, precisely the same electrical tests may be made on magnetic speakers of the balanced armature type. Any other troubles will be of a mechanical nature.

26-16. Repair of Horn-Type Magnetic Speakers.—As has already been explained, horn-type magnetic speakers should be repaired only when the troubles are of a minor nature or when the owner insists on such repairs being made. Major repairs involving the removal of one or both of the coil bobbins, etc., usually take considerable time and require skill and patience. The parts of such speakers are delicate and crowded close together.

Replacement with one of the balanced-armature cone type speakers which are now available at extremely low cost will usually be much less costly and give more satisfactory performance. However, if the faulty speaker must be repaired, the service man will have to do the work. A brief description of some of the mechanical service problems which may be encountered now follows.

A cross-section view of a typical horn speaker unit of the balanced-armature type is shown in Fig. 26-9. A speaker unit of this type with the parts disassembled is illustrated in Fig. 26-10. It consists, essentially, of a case, two magnet coils mounted over the pole pieces of a permanent magnet, and a diaphragm suspended between rubber gaskets and a steel washer. The diaphragm is held in the upward position by a wavy spring washer, which is shown at the extreme left in Fig. 26-10. Of course, not all units are constructed exactly as shown here, but the illustration is typical of the majority of them, and the following service notes will, in general, hold for all types.

Iron filings or other foreign matter may collect on the pole pieces and cause rattling and low volume. The filings around the sides may be removed with a pocket knife by working outward and upward from between the pole pieces. Those filings on top of the pole pieces may be removed by simply wiping them off with a clean cloth. The thin varnish-like coating on the pole pieces is used to prevent the formation of rust. This coating often peels, so that it is necessary from time to time to remove the small flakes of it that collect on and about the pole pieces. Rubbing some light mineral oil on the pole pieces will assist in preventing the future formation of rust.

The spring which may loosen its tension and produce insufficient pressure against the diaphragm, causing rattling on high volume, may be replaced, or all of the bends may be heightened by hand to supply the desired pressure. It is important here to be certain that all bends have exactly the same height. A simple test is to place the spring on a flat table and place the diaphragm on top of it. A small level may then be placed on top of the diaphragm. The bends may then be adjusted for equal heights. It is wise to test the level of the table before bending the spring.

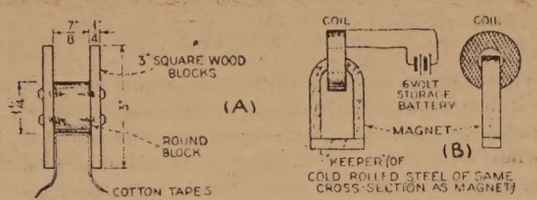
The rubber gaskets are used to damp the vibration of the diaphragm at its natural frequency. They may dry out and lose their elasticity after some use. This condition will manifest itself by rattling at some particular frequency, and by poor tone quality. The remedy, of course, is to replace the gaskets with new ones of live rubber, as they cannot be repaired.

The diaphragm may be bent, buckled or dented. If this occurs, it should be replaced. In many cases, the underside of the diaphragm has rusted, the rust clogging the small air gap between the diaphragm and the pole pieces. Unless the diaphragm is replaced in such cases, the rust spots should be cleaned thoroughly, and a coat of thin lacquer or varnish applied to protect the metal.

Weak magnets give rise to weak and "tinny" reproduction. While more elaborate tests may be made, service men usually test permanent magnets for strength by touching the magnet face or the pole pieces with a screw driver. A tenacious "pull" should be felt. Of course, experience teaches how much pull to expect for strong magnets and for weak magnets, since the size of the magnet should also be considered. If there is only a weak pull, or none at all, the permanent magnet is demagnetized and should be either replaced, or removed from the unit and remagnetized by the method described in Art. 26-18.

Speakers.—The electrical tests to be made on balanced-armature type magnetic speaker units of either the cone or horn type are precisely the same as those outlined in Art. 26-15, and illustrated in Fig. 26-8, for iron-diaphragm type speakers. First the cords, and then the coils are tested for continuity, shorts, and grounds by means of an ohmmeter. Any electrical troubles revealed by these tests should be eliminated either by repair or replacement of the part in question. The service man should keep in mind what has already been said in Art. 26-15 about the advisability of making major repairs on these speakers.

26-18. Remagnetizing Permanent Magnets. — If the magnet test described in the last paragraph of Art. 26-16 reveals the



Courtesy Radio News Magazine

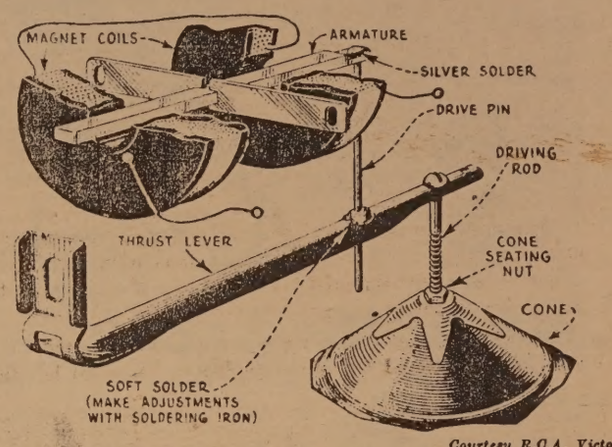
FIG. 26-11.—Construction details of a coil which may be used to remagnetize the permanent magnets of loud-speakers and phonograph pickups. The winding form for the coil is shown at (*A*). The method of magnetizing is shown at (*B*).

permanent magnet of a magnetic-type loudspeaker, or a phonograph pickup unit, to be weak, it should be remagnetized. Magneto and automobile ignition service stations are equipped to remagnetize permanent magnets quickly and at small cost. However, if the service man desires to do this work himself, the simple arrangement of Fig. 26-11 may be employed.

The magnetizing coil should be constructed first. A form on which the coil is to be wound must be made. The details of this form are shown in (*A*) of the figure. Note that the sides of the form are attached to the core of round wood by means of wood screws; this is quite essential, as the form is to be taken apart after the coil is wound. After the form is made, two layers of wrapping paper are wound over the core; then several strips of cotton tape are placed in the trough of the form, at intervals around it, as shown at (*A*), and spot-glued to the sides with a little mucilage to keep them in place while winding the coil. Now wind 196 turns of No. 16 d.c.c. wire in 14 layers of 14 turns per layer; this requires one pound of wire. After winding, the cotton tape is bent over the top of the coil to hold the turns in place. The end pieces of the form are then removed and the core slipped from the center of the coil. If desired, additional tape may be wound over the coil to hold the turns of wire in place, although impregnating the coil with paraffin or pitch will help it to withstand rough usage.

The magnet to be remagnetized is then slipped through the opening in the coil and a "keeper" of cold-rolled steel is placed across the terminals, as shown at (*B*). The coil terminals are then connected to a 6-volt storage battery for a few moments (the magnetizing process is *almost instantaneous*). The drain on the battery is about 12 amperes, which is well within the limits of an ordinary battery used for automobile starting The battery should be well charged! The magnet should be struck a few sharp blows with a small hammer while the current is turned on. This will aid the molecules to rearrange themselves to produce the magnetized condition. The coil is then disconnected, removed from the magnet, and the job is finished. This magnetizing coil is adequate to saturate all types of small permanent magnets including those of earphones, magnetic speakers, phonograph pickups, etc. The coil may be placed at any position on either leg of the magnet if necessary; it is not essential that it be placed at the bend as shown at (*B*). Permanent magnets should never be allowed to lie around unless a soft iron keeper (which may be an ordinary large iron nail) is placed across the poles.

26-19. Repair of Balanced-Armature Type Magnetic Speakers.—Figure 26-12 shows a cut-away view revealing the construction details of the typical form of motor unit employed in magnetic speakers of the *balanced-armature* type. The permanent magnet and its pole pieces have been omitted purposely as they would make it impossible to see the coils and the armature. These parts may be seen in the illustration at the right of



Courtesy R.C.A. Victor

FIG. 26-12.—Cut-away view showing the essential components in the motor of a typical balanced-armature type loud speaker unit. The permanent magnet and pole pieces have been omitted for clarity.

Fig. 26-13. Two magnet coils containing many turns of fine enamel-covered wire are wound over an armature which is pivoted between the pole pieces of a horseshoe-shaped permanent magnet, as shown in Figs. 26-12 and 26-13. The armature connects to the thrust lever (Fig. 26-12) through a drive pin, and the thrust lever actuates the cone of the speaker through the driving rod.

The trouble symptoms that may arise in balanced-armature type magnetic cone speakers are weak reproduction, no reproduction, distortion, noise and rattle. There are a number of causes for these symptoms, and each cause may give rise to more than one symptom. For this reason, the troubles will be listed and considered according to their causes and remedies. A summary of the common symptoms of trouble which develop in balanced-armature type cone speakers, and their causes follows:

1. No operation:
   - (a) open cord
   - (b) faulty tip terminal joints
   - (c) open coil
   - (d) open coil leads to terminals
2. Weak operation:
   - (a) weak magnet
   - (b) shorted coil (partial or complete)
   - (c) grounded coil
3. Noisy operation:
   - (a) frayed cord
   - (b) internal defect in cord
   - (c) poor joints at cord tips
4. Distortion or rattle:
   - (a) armature striking pole pieces
   - (b) sticking armature
   - (c) foreign matter interfering with armature action
   - (d) torn or otherwise damaged cone
   - (e) improperly seated cone
   - (f) loose thrust lever
   - (g) bent drive pin
   - (h) loose or bent drive rod

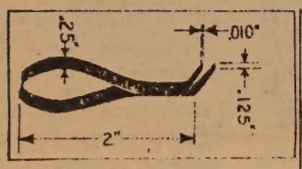
The first three trouble symptoms have already been considered in Arts. 26-15, 26-16 and 26-18. The troubles which may cause the last one, and the remedies for them will now be considered.

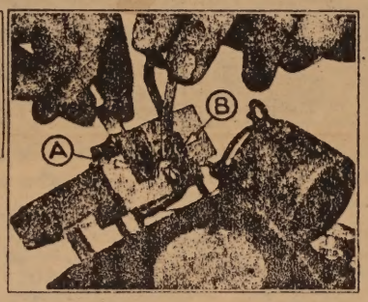
26-20. Recentering the Armature of a Balanced-Armature Speaker Unit.—If the armature is not centered correctly between the pole pieces, a very disagreeable rattle and distortion may result on loud notes. The space between the armature and each pole piece is different in different makes of speakers, but the average is about 0.1-inch. If the armature is misaligned, it may be realigned by the following method. Two similar spacer tools are required, and may be made up by the service man. They are simply pieces of non-magnetic sheet metal cut to the proper size and shape and of the proper thickness to be inserted between the armature and the pole pieces. A sketch of a typical spacer tool is shown at the left of Fig. 26-13. It consists, essentially, of a strip of phosphor bronze or brass having a thickness equal to the spacing between the armature and pole pieces and about ¼-inch wide and 6 inches long, bent into the form shown. The ends should be tapered to a width of ⅛-inch.

Two of these tools are necessary when adjusting the armature. Insert the prongs of one tool in the spaces between the armature and pole pieces at one end of the unit, as shown at the right of Fig. 26-13. The other tool should be placed in similar position at the other end of the armature—a little to one side in the case in order to clear the drive pin which is located at this end. By loosening screws (*A*) and (*B*), any tension in either direction that may have been on the armature is released, and the spacer tools will provide the correct clearance or spacing. Now while the spacer tools are in place, a hot soldering iron is applied to the drive pin—thrust lever connection point (see Fig. 26-12), and the solder is heated sufficiently to allow the drive pin to find its normal position with regard to the thrust lever. (Since the solder used at this joint has a low-melting point very little heat is necessary.) The iron is now removed. Screws (*A*) and (*B*) are now tightened and the spacer tools are removed.

The armature is now correctly aligned and balanced so that no abnormal strain is being imposed upon it in any direction, and it is correctly centered between the pole pieces so rattling should not occur on normal signal volume.

26-21. Freeing a Sticking Armature.—Very often the armature of a balanced armature speaker is found to be sticking





Courtesy R.C.A. Victor

FIG. 26-13.—*Left*: Dimensions and form of a spacer tool for centering the armature of a balanced-armature type speaker.

Right: How the tips of the spacer tools are inserted (one at each end of the armature) so that the armature is held in a centered position between the pole pieces.

(by magnetic attraction) to the face of one of the pole pieces at either end. The repair in such instances is the same as for the incorrectly centered condition of Art. 26-20. The assembly must be loosened and the armature spaced properly with spacers. Be certain that all screws are tight, as a sticking armature may be caused by one or more of the tension screws working loose because of vibration and allowing the armature to sag to one side.

26-22. Removing Foreign Material from the Air Gap. — Foreign matter lodged between the armature and pole pieces is a frequent cause of trouble. This interferes with the movement of the armature, resulting in poor reproduction. A visual inspection will reveal this condition. This foreign matter may consist of dirt and dust, small pieces of iron filings and peelings from the coating on the armature. The armatures of loud speakers are usually given a protective coating to prevent the formation of rust. In time, especially if the motor temperature becomes high, this coating has a tendency to peel, and the small flakes lodge between the armature and the pole pieces. This is the equivalent of reducing the armature spacing, with the result that the armature motion is reduced and the output is weakened and distorted. This foreign matter is best removed by working small strips of heavy paper or strips of thin copper or brass back and forth between the armature and pole pieces. Every time the paper or metal is removed, clean it off before reinserting. The spacer tools already described may also be used for this purpose. In many instances, recentering of the armature is necessary after cleaning. It is also a good idea to rub some light mineral oil over the armature to prevent the formation of rust after peeling has occurred.

26-23. Repairing the Cones of Magnetic Speakers.—Very often, the paper cone is damaged sufficiently to cause distortion or paper rattle, but not enough to make its replacement necessary. Small holes or tears in the paper may be repaired by cementing a small piece of paper over them, using Du Pont Household Cement, rubber cement, etc. Opened seams may be repaired by coating both surfaces with cement and holding them tightly together until the cement sets.

If a cone has lost its "body" or stiffness at the apex, Dupont Household Cement, or a collodion solution (which may be purchased at any drug store) should be soaked into it and allowed to harden. This will stiffen the paper and make it as good as new.

26-24. Replacing and Seating Cones.—An improperly seated cone will cause a strain to be put on the driving rod, resulting in poor reproduction. This is very likely to occur when replacing a cone. If a cone is to be replaced, extreme care should be exercised in its removal and in the installation of the new one. The screw or nut in the apex of the cone should be removed carefully, after first removing any sealing wax which may have been used to prevent it from loosening. The screws fastening the edge of the cone should be removed next.

If the speaker has a nut on the side of the cone near the thrust lever, it should be loosened (the nut screwed back) and the new cone seated. The nut or screw and washer on the outside of the driving rod should then be attached loosely. The holes at the edge of the cone should now be lined up with those of the metal frame, the outside ring put in place with the screws, and tightened one at a time (and a little at a time) to be sure that the entire periphery of the cone has the same tension. The back nut on the driving rod (if there is one) should then be screwed up until it just meets the apex of the cone. The front nut or screw is then tightened and a bit of sealing wax is placed over it to prevent the vibration from loosening it, for, if it loosens, considerable buzzing and rattling will result.

26-25. Tightening the Thrust Lever and Driving Rod.—Rattling and noisy reception are often caused by a loose thrust lever, see Fig. 26-12. The remedy for this is simply to tighten the screw that holds it to the motor assembly. Any loose screw or nut will cause an audible rattle when the speaker operates. Be certain that all parts are thoroughly secure, that all screws and nuts are tight, and that the cone is properly seated. A cone that is not properly seated may cause the drive pin to bend and displace the armature. It is best, therefore, to inspect the entire assembly before actually beginning to center the armature, if it appears to be displaced from its center position.

The drive pin is soldered to the iron armature with (hard) silver solder (see Fig. 26-12). Do not use the ordinary tin-lead alloy (soft) solder when this connection must be resoldered, as it is too weak mechanically. Silver solder may be procured in any jewelry store, and must be applied with a flame of high temperature. A special small blow torch is usually used for this work.

FROM:
MODERN (OLD) RADIO SERVICING

DONATED BY JAMES A POLLARD, SAN DIEGO, CALIFORNIA

MEET OTHER COLLECTORS, ADVERTISE IN THE HORN SPEAKER SOON

John Field Lives In 'The Time Machine'

Sunday, May 15, 1977 — People And Places — Santa Cruz Sentinel —

By DALE POLLOCK
Sentinel Staff Writer

H.G. Wells wrote about "The Time Machine," but Dr. John Field lives in one. Field's home is a museum of the most casual and uncluttered kind, with an amazing assortment of mechanical machines, instruments and electrical devices that dazzle the eye and bewitch the ear.

Field has a collection of player pianos, orchestrions, victrolas, a violana virtuoso and a hallowed treasure, a 1920s Wurlitzer movie theatre pipe organ, that would make most Americana collectors salivate.

Many of these instruments are in the process of being fully restored to be both workable and enjoyable, as they once were to their long-ago owners. But thanks to Field's incredible committment to what is essentially a lost art form, each instrument or machine has a story of its own to tell.

So, in fact, does Field. "I got started in this thing by accident," he recalls. "I was given the music box owned by my great-grandfather, who was also named John Field. He purchased it at the 1876 Centennial, and even though it was made in Switzerland, it had American tunes on it."

It was simply a quick jump from music boxes (and we're not talking about the jewelry-size container here that plays the theme from "Love Story" — these are mechanical marvels, playing hand-crafted cylinders) to victrolas, and Field was on his way to what has become a lifelong obsession.

He finds his hobby even meshes with his career as an orthopedic surgeon. "Orthopedic surgery is the most mechanical job in medicine," he shrugs.

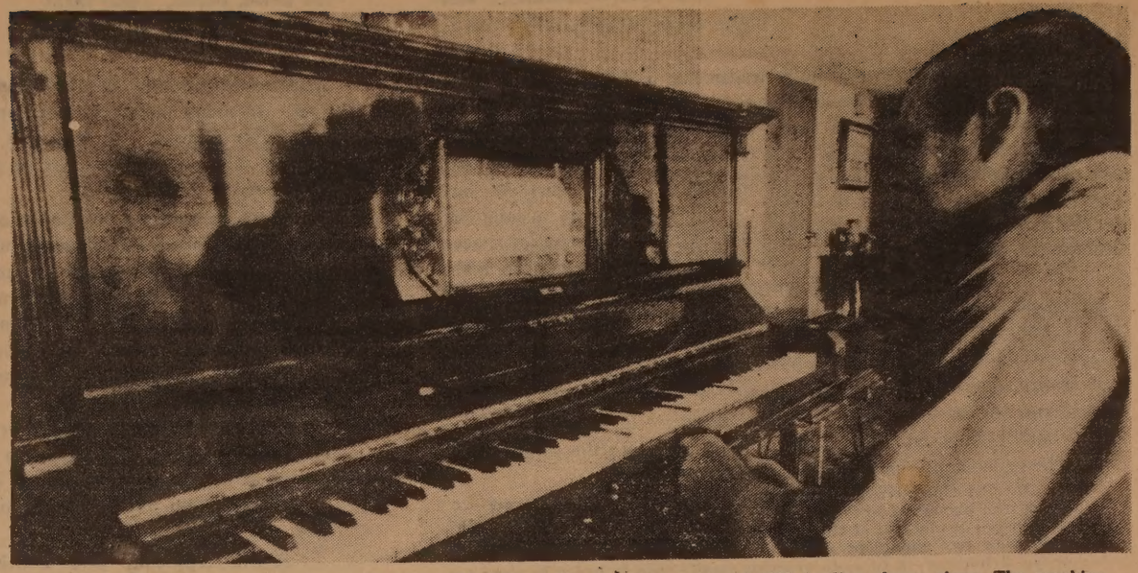
And from talking to Field, his passion is machines. A walk through his home is like a stroll backwards in history, a page out of "Ragtime." Suddenly you're in the days of hurdy-gurdy dancers, free lunches at the bar, and a sentimental Irish tenor in the background.

Field started out with cylinder and disc music boxes. The cylinders were made by hand by families in Switzerland who had performed the same craft for generations. "The impressive thing is that the tune stays in perfect cadence," says Field as he demonstrates one machine. "That's the result of careful handiwork."

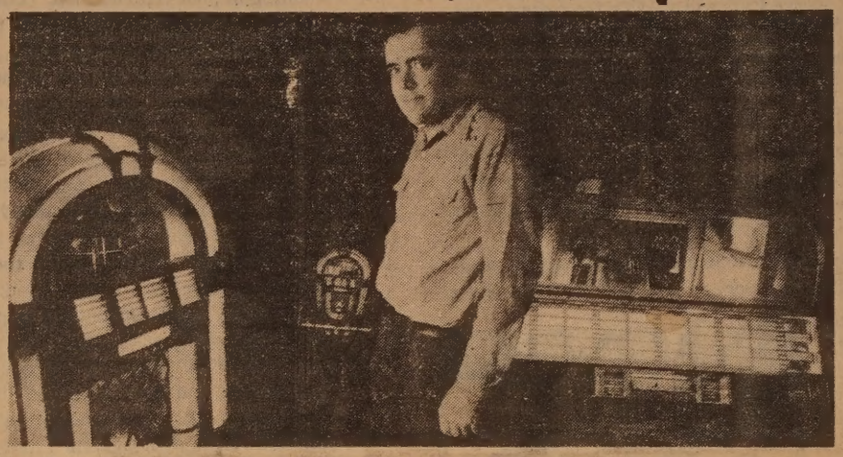
But the invention of the disc player spun the cylinder right out of business. For one thing, there was the price, explains Field. "Cylinders were at least $100 for ten tunes, while discs were only $1 apiece. In fact, the cost of records since the disc has remained rather stable, compared to other items."

Field has in his possession a "Stella" disc music box that dates from 1900, made by Mermad Freres in Switzerland, along with 50 or so discs that can be played on it. Seeing the pitted metal discs spin around, sparking at the needle to produce its slightly tinny sound, is an exercise in nostalgia.

"Mechanical music machines date back at least 500 years," reminisces Field, adding that they started out in clocks and snuff boxes. "But they came into their own in the 19th century, even though the disc wasn't thought of until 1890. In short time, though, it made the older cylinder boxes obsolete. Discs sounded better and were easier to change the tunes on."



Dr. John Field watches as a piano rolls spins out a tune on his gleaming, restored 1902 Aeolian player piano. The machine has 16 coats of lacquer, and was hand sanded and polished.



Dr. John Field with three of his prize vintage jukeboxes. The flashy art deco model on the left was one of the most popular juke boxes in the 1940s, while the machine in the center plays 78 rpm recordings. The model at right is familiar to pizza lovers and barflies the world over.

As the sounds of "The Wedding March" blare forth, Fields sighs, and says, "This disc has played for many weddings, including my own. Some things don't change."

The bulk, literally, of Field's collection, though, are his player pianos, of various types and levels of sophistication. A restored 1902 Aelion player piano, one of the first models in the country, is a gleaming gem, with levers for speeding up or rewinding the piano rols, and pump pedals for controlling the volume.

Field sits at the self-motivating keyboard like a passive Phantom of the Opera, letting the machine do all the work except the difficult pedalling.

"When the holes in the music are uncovered, it lets in air that operates the valves. And the valves let in a vacuum to the pneumatic, and that strikes the keys. This is really one of the first self-contained player pianos. The earlier models had wooden fingers that were pushed next to the piano, and those were controlled by vacuum, too.

Elsewhere in the house, plastic neon jukeboxes glow like eerie reminders of a sanitized 1940s diner. Pinball machines lurk in the corners, but Field is lecturing on an early victrola, noting, "This is what put music boxes out of business. They couldn't reproduce the human voice, and this could, so the music box industry was dead by 1910. Cylinder phonographs made a comeback between 1912 and 1920, but they lost out because cylinders were hard to store and hard to duplicate in the manufacturing process. Still, Edison kept making cylinders up to the time of the Depression."

A prize of Field's collection is a true original, the reproducing piano, which does exactly what its name says it does. "It has special rolls that will hit each note with exactly the right degree of intensity. You could actually hear, therefore, a real concert pianist playing the piano without his having to be there."

Such famous pianists as Rachmaninoff actually went into a special recording studio and made the rolls for distribution to owners of the reproducing machines.

"The recording piano had mercury switches under the keys, and each piano hammer had an electrical contact hooded up to the coil. When sparks were passed near the strings, as the keys were hit, they would be recorded as long marks on a very rapidly moving roll. It was a very clever system, because you ended up with two rolls, one showing where the keys hit, and the other how hard they hit. It took two weeks to translate all this data to a code roll, and then those would be duplicated."

Field hopes to have his reproducing piano restored within a year, and the next time a famous pianist visits Santa Cruz, he or she might be asked to leave the community a permanent legacy in terms of a concert on a piano roll.

That will be just one more addition to Field's collection of 1200 rolls and even more cylinders, one of which has Thomas Edison's voice on it, the only cylinder of its type in the world. But not all the material is of the smaller variety. Occupying the center of the room like a sleeping behemoth is a 1920s six-ton Wurlitzer theater organ, intended to accompany silent film presentations.

Field located the organ in Long Island, and picked it up for a scant $2,000. Then it took him three days, from sunup to sundown, to crate it and drive it by truck across country. "This organ was in the home of William Fox, the founder of Twentieth Century-Fox film studios. He had his own private theater in his home on Long Island, Fox Hall." And sure enough, an elaborate red velvet organ cover is emblazoned with a gaudy Gothic "F."

While the organ remains disassembled, Field is busy restoring it, one of the 20 or 30 jobs he seems engaged in simultaneously. It has 600 pipes, and is the musical equivalent to the potential of a 2000 pipe straight or classical organ. "It's relatively small as pipe organs go, but when fully assembled, it seems huge to one person. It has a train whistle, a xylophone, a glockenspiel, a harp, oboes, drums, tambourines, castanets — all the effects for silent films, including thunder and lightning."

Fully restored, the organ would bring $10,000, but Field is most certainly not in it for the money. He belongs to the American Theatre Organ Society, the Musical Box Society, and the Automatic Musical Instruments Association of America, all groups of people dedicated to listening and fooling around with these machines. They have annual meetings scheduled around the great remaining organs, such as one in Atlantic City or another giant in Chicago. "Organs are a resource you can't duplicate once you take it out of its environment," Field believes.

The list goes on and on, of course. There are orchestrons, halfway between a piano and an organ, that in effect supply the backing of an entire symphony, right down to the chimes. The automatic rolls turn the organ valves that supply the recreated instruments, although there is nothing electric in the machines. All they use is vacuum and air pressure.

Field is a fount of musical trivia, and the facts pour from his lips. His Violana Virtuoso is currently on display in the Nickelodeon Theatre, and is one of only 400 or 500 surviving machines.

"A European model had three violins and a reproducing piano, and for one concert, they moved in 87 of the violin machines. Now that was a string section."

Although the player piano industry is far from dead, "they don't make player pianos at all equivalent to the old ones. They still manufacture rolls and parts, and there are enough older models around now that no one throws them away anymore. But electrical amplification really ended the mechanical music era," Field says, almost sadly, surveying his resurrected collection.

"I really want a museum, with the theatre organ as the centerpiece. We've also purchased several other machines that are in storage, and lots of other items that would prove of interest." But Field says he would be happy to allow a suitable pizza place or restaurant to showcase his Wurlitzer beauty. The rest of his collection, he believes, is best kept together.

"These are a signpost of our mechanical and musical heritage. They are worth preserving. That's my goal."

OLD

Radio News for September, 1926

An ~~Ultra-Modern~~ Radio Factory

By B. H. BAKER

As radio has taken its rightful place as an American industry, methods are being developed for mass production, the ultimate goal of every manufacturing development. Here is a description of the methods employed for the making of a complete receiver.

THE views of a large factory devoted to all stages of radio set manufacture, which accompany this article, offer conclusive evidence that the manufacture of radio receivers has taken its place as one of the industries in which highly systematized, mass production is an essential of success. A new building, erected in 1922, has been rapidly outgrown, necessitating an addition in 1925, which increased the floor space by approximately 60,000 square feet. All is constructed of reinforced concrete and represents the most advanced type of factory design.

As the visitor approaches the factory, he is impressed not only by the attractiveness of the building itself, but also by the pleasing, well-kept grounds which surround it. Inside the factory, the first impression is probably that of an unusually high degree of cleanliness. A big factor in the maintaining of this condition is the employment of the modern type of factory window to the greatest possible extent. In addition to thus obtaining the maximum amount of sunlight, the inside wall areas and ceilings are finished in white enamel.

It might be mentioned here that these three factors of sunlight, cleanliness and good air play a big part in creating a loyal, capable force of men and women. Labor turnover is unusually small. Large recreation and rest rooms, a tennis court, dances and parties all contribute to make this factory and this organization especially successful from this viewpoint.

The arrangement of the various departments has been carefully worked out in order to facilitate the progression of operations which convert the raw material into the finished apparatus. Incidentally, every part of the receiver is made in this factory, with the exception of cabinets and wire.

The first floor is devoted entirely to the processes of turning raw material into parts for assembly into the various units. One section of this floor is a completely equipped toolroom. Here, with the aid of the finest machines available, expert toolmakers turn out all of the special tools, dies, fixtures and jigs which are required.

Photos courtesy of A. H. Grebe & Co., Inc.

Above is shown the final assembly of the sets, with the operators who wire them. Belt conveyor systems are used throughout the plant; and a section is here shown, carrying the sets from the workers.

At the right is shown the section of the plant where parts are assembled. In the foreground are operators assembling and inspecting variable condensers.

The belt-conveyor system brings the assembled sets to inspectors, who give them rigid mechanical and electrical tests.

AUTOMATIC MACHINERY

In another section of this floor is a press department consisting of a battery of eight of the latest type presses, on which are stamped out all of the sheet metal parts used. Here, also, is a battery of eight automatic screw machines for turning out the special screws and machine parts.

The importance of molded composition in modern radio construction is evidenced by the ten electrically heated and thermostat-controlled molding presses which occupy another section of the first floor. Here, too, the sheet insulating material is cut and drilled. Nearby is the polishing department where the finishing touches are put on the various parts thus made.

BELT-CONVEYOR SYSTEMS

On the second floor we find that the finest kind of efficient production methods are employed in the assembly of parts into the thirty odd units which are built into the receiver. The manufacturer has found it necessary to design and develop many special machines for this work, such as coil winders, rheostat winders, variable-condenser stackers, automatic riveters, engraving machines, as well as a great variety of standard small machine tools.

The third floor of this modern factory is given over to the final assembly, testing and packing departments. Here the latest types of continually-moving belt conveyors play a big part in speeding up these activities. Individual benches are located on both sides of the belt conveyor, and operations are laid out to permit assemblers, working in pairs, to remove a receiver from the conveyor, perform their operation and return it to the belt which carries it on to the next pair of workers.

Thus, following the most advanced factory policy, the embryo receiver is moved systematically and efficiently from the first to the final assembly, and then to the final inspection and test departments. Here the receiver is actually tested on broadcast reception, and a record made of the dial readings for several stations. This record, which accompanies the receiver, serves as a guide to the buyer in the operation of his receiver, though there is little variation between any two of the same model, owing to the high degree of standardization.

After the reception test, the receiver is returned to the conveyor, and proceeds to the cabinet assembly department, where it is mounted in the cabinet and prepared for packing. Two cartons are used, the outer

The molding department makes the different insulating composition parts, using thermostatically-controlled presses.
Courtesy of A. H. Grebe & Co., Inc.

one being a specially-constructed air cushion container which prevents damage in transit.

BROADCASTING AND EXPERIMENT

The fourth floor of this factory is devoted to the activities of the engineering staff and to two broadcast stations which the company maintains. Here, also, are two experimental stations through which this firm keeps in touch with amateur operators throughout the world. In connection with the broadcasting we find on this floor well-appointed reception rooms, large and small studios, control rooms, and the office of the broadcast officials.

Mounted on the roof are three lattice-type towers which permit the use of horizontal aerials two hundred feet above the ground. The engineering skill employed in the construction and operation of this station is evidenced by the fact that although the power used is only 500 watts, programs from these studios have been heard in nearly every part of the world. Broadcast listeners in Australia, for instance, frequently write and even cable their applause.

HIGH ACCURACY REQUIRED

It is difficult, in so brief an article, to do justice to the scientific care which is such an important part of the building of the receiver. The corps of inspectors, for instance, is approximately twice as large, in relation to the production force, as is customary in the automobile industry. These inspectors are really expert at their respective jobs, and do nothing but test and inspect various parts and units of this receiver.

The testing of the receiver involves the use of hundreds of specially designed instruments. The accuracy of these tests is guaranteed by the fact that engineers, in their laboratories, daily test and check over these various electrical testing instruments. Even the man who is not a radio enthusiast is certain to appreciate the precision and care which is evidenced in every part.

Club News

SOUTHEAST MEET

The Southeastern AWA Meet will be at the Holiday Inn North, 3050 N. Cherry St., Winston Salem, North Carolina 27105, on June 9 and 10. For more information write: Lew [illegible] Drive, Win[illegible] 27106. Make reservations with Holiday Inn.

SOUTHWEST MEET

The Vintage Radio and Phonograph Society (formerly Southwest Vintage Radio and Phonograph Society before most of its officers declared it to be national) will hold its meet on July 28, 29 and 30 at the Royal Coach Inn in Dallas, Texas. For more information write: V.R.P.S., P.O. Box 19406, Dallas TX 75219.

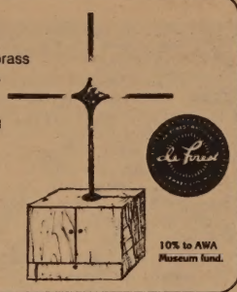
For Sale...

PROFESSIONAL REPRODUCTIONS

deForest LOOP ANTENNA

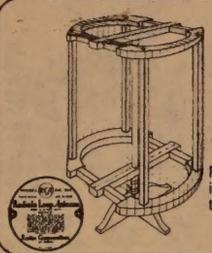
Beautifully prefinished and assembled with over 100 machined brass fittings and Bakelite parts, with a DeForest decal. Fits all D-7, 7A, 10, 12, and 17 sets. "DeForest wire included."

$67.50 postpaid



10% to AWA Museum fund.

RADIOLA LOOP ANTENNA AG-814



Precut Mahogany frame with an etched brass name plate and 1924 instruction card. This loop is a great addition to any collection and fun to assemble. Includes radiola type wire.

$43.50 postpaid 10% to AWA Museum fund.

Radiola Grand Speaker Grills

Unfinished Mahogany is precision cut to the 1922 pattern. Needs only staining to complete your rare and unusual radio.

PRICE $15.50 postpaid

Radiola Antenna Wire

Multi strand copper wire with a brown braided Celulon cover just like the original 500' roll —

PRICE $35.00 postpaid

Smaller Lengths — 9¢ ft.

Radiola V & VI Wooden Tops

Always missing, this solid Maple reproduction is the crowning compliment to another uncommon set. Unfinished.

PRICE $19.50 postpaid

"NEW"

DeForest Type Green Wrapped Litz Wire Avail.

100' Roll

PRICE $10.00 postpaid

SATISFACTION GUARANTEED ON ALL ITEMS OR RETURNED FOR FULL REFUND.

GLENN S. STREETER 4133 VIA NIVEL, PALOS VERDES ESTATES, CA 90274 - (213) 375-5522

LETTERS

Dear Jim:

Have acquired 5 radios this year, including Stewart Warner 300, Stromberg Carlson 501-2 and home brew Cockody 3 tube set.

Bill,
Bill Morford
Mallory Road
Central Square N.Y.
13036

Attn. Jim Cranshaw;

Enclosed is a check for $5.50. Please renew my subscription for another year, to your excellent publication.

Thank you,
Robert C. Pote

P.S. Would appreciate more articles concering AC radio sets 1930-1940.

Robert C. Pote
1530 E. Naomi St.
Indpls., IN 46203

Dear Mr. Cranshaw:

Greetings! Enclosed is a copy of the Atwater Kent Mfg. Company from one of my instruction manuals. I hope you will be able to use it in a future issue of THE HORN SPEAKER. Which I look forward to each month.

Keep up the good work.

Sincerely,
Jerry Rappel
5112 N. Fairmount, #120
Davenport IA 52806

"MOST POWERFUL IN THE WORLD"

Navy Model

UNIVERSAL TRANSOCEANIC

Design by CHAS. R. LEUTZ

LICENSED UNDER HOGAN PATENT 1,014,002

Wavelength Range 35 Meters to 3600 Meters

Full details are given in our 88 Page Catalog Free.
Wire or write for your copy today.

MANUFACTURED BY

GOLDEN-LEUTZ, Inc., Sixth & Washington Aves., Long Island City, N. Y.

CABLE "EXPERINFO"

The Universal Transoceanic is supplied completely constructed and laboratory tested and is also supplied in Kit form, all parts ready for assembly. The complete set of Constructional Blue Prints covering all mechanical, electrical assembly details, wiring diagrams and instructions will be mailed upon receipt of $5.00 net.

1926 AD

Dear Jim:

I'm having a problem with a radio I've recently acquired. In the past I've had remarkable luck in acquiring data and schematics for obsolete equipment. I've run the gaunt of my sources for information concerning this particular piece of equipment, however. Perhaps one of the HORN SPEAKER'S readers could be of assistance. Does anyone have any literature, schematics etc. on a Telefunken hand crank emergency lifeboat transciever, Model SE 102 MK 0.005/2? As best as I can determine it is for 8.2 - 8.75 MHz. I intend to convert it for 40m amateur use.

I guess this is also a good time to thank you for three years of enjoyment I have obtained from THE HORN SPEAKER.

Sincerely yours,
73

Ray Carifio
413 Cadagua Ave.,
Coral Gables FL 33146

EDITOR...Someone help Ray, and thanks for the kind words.

FIND OF THE MONTH

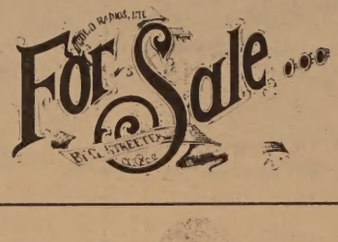
How's this for a find of the month ---?

While visiting an Antique Store a few weeks ago, I came across an AK model 70 console. Being an AK collector, I purchased it for an unheard of price - $15.00. The condition was excellent, except for a small tear in the speaker cone. After cleaning it that evening, I received more than 20 stations on it, including WLAC in Tennessee.

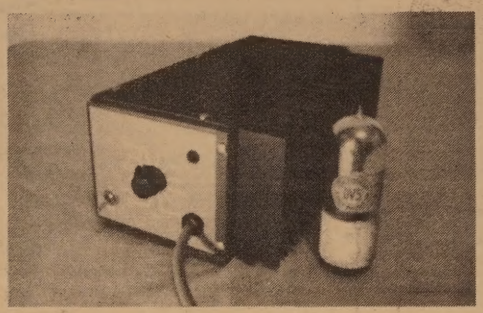
This has been my best find, and it's the third AK I've located in this area. Which proves they are still around, all you have to do is hunt for them.

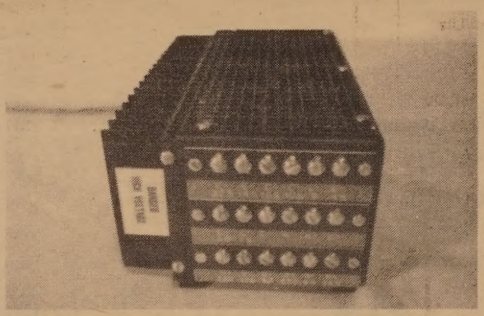
Also in this shop were an RCA and two Edison floor model phonographs in fair condition. He was asking $50.00 each. Covered with dust in the corner were various knobs, from AK to Kilograd, plus a few variocouplers.

Jerry Rappel
5112 N. Fairmount, #120
Davenport IA 52806



H-10 POWER SUPPLY





Now! For the first time a premium quality power supply. The H-10 power supply is made of specially designed and the highest quality components (not surplus or used parts).

And it's not being assembled in someone's garage. The H-10 has been contracted by a top-rate manufacturer who builds power supplies primarily for the laser industry. Thus it is fully warranteed for a full year.

And no other power supply offers as many regulated outputs.

The Model H-10 is a premium quality regulated power supply designed to power over 99% of all battery radios. The Model H-10 was developed primarily for the radio collector but is capable of operating virtually all battery sets manufactured between 1920 and the end of the vacuum tube era around 1960.

The Model H-10 contains three independent, electrically isolated, regulated power supplies. The "A" supply provides 12 switched outputs between 1.1 and 9V. The "B" supply can deliver up to *6 simultaneous* regulated outputs. The "C" supply can deliver up to *8 simultaneous* outputs. All outputs feature electronic short circuit protection.

TYPICAL SPECIFICATIONS

Input	117V AC, 50-60Hz, 80W maximum.
Volts	1.1, 1.5, 2.0, 2.5, 3, 3.3, 4.5, 5, 6, 7.5, 8, 9
"A" Output	Single output switch selected, short circuit protected, ripple less than five millivolts RMS @ 5V and 5A, regulation 0 to full load .02% @ 5V, voltage tolerance 5%, overload protection. Using the 1.1V, 3.3V and 5.0V output, allow operation of appropriate tubes with no danger of burn-out from improper filament rheostat adjustment.
"B" Output	22.5V, 45V, 67.5V, 90V, 135V and 180V may be used in any combination with a maximum total output of 50mA. Ripple is less than five millivolts RMS @ 22.5V and 50mA to less than 25mV RMS @ 180V and 50mA, voltage tolerance 5%, voltage regulation 0-50mA 2.5%, fold-back current limiting.
"C" Output	1.5, 3.0, 4.5, 9, 10.5, 13.5, 16.5 and 22.5V; 50mA @ 22.5V, ripple less than five millivolts, voltage tolerance 5%, regulation 0.1% at 22.5V. All other voltage obtained by a 25mA resistive voltage divider. Overload protected.
Controls	Power switch, "A" voltage selector switch, LED pilot light.
Line Cord	Three-wire, 6 ft., heavy duty.
Size	3¾" H. x 5¼" W. x 9½" L. (includes controls).
Weight	5 lbs., 14 oz.
Limited Warranty	Warranty is limited to repair or replace, at our option, of any defect in materials or workmanship for a period of one year. Warranty does not cover shipping costs.
Ordering Information	Include check or money order for $149.95 to Glenn S. Streeter, 4133 Via Nivel, Palos Verdes Estates, CA 90274. We will pay shipping by UPS.

MEET OTHER COLLECTORS, ADVERTISE IN THE HORN SPEAKER SOON

ONLY A FEW 1973 BACK ISSUES OF THE HORN SPEAKER LEFT

MEET OTHER COLLECTORS, ADVERTISE IN THE HORN SPEAKER SOON

ANTIQUE RADIO CLUB OF AMERICA

1978 Conference
JUNE 15 - 18
Early Registration: $3.00

George Washington Motor Lodge
Exit 24, Penna. Turnpike
King of Prussia, Pa. 19406

** History of General Electric Tubes -- Lauren Peckham
** Show and Tell -- Mel Comer
** Introduction to Federal Receivers -- Dick Schaumberger
** And the Flood Came -- Lou Moreau
** What Set is This? -- Dick Ransley
** Tune in Atwater Kent -- Ralph Williams
** Story of the AWA Museum -- Rod Phillips

at the George Washington Motor Lodge in King of Prussia. Located at Exit 24 of Pennsylvania Turnpike, on Routes 202 and 363.

RATES: Single -- $23.00 plus tax
Twin -- $31.00 plus tax
$ 5.00 for each additional person sharing room

Make your own reservations at the motel as soon as possible. Be sure to mention ARCA so that we will be assured a block of rooms and FREE meeting areas. Write to the George Washington, Exit 24 Pennsylvania Turnpike, King of Prussia, Pa. 19406 -- or TELEPHONE: 215 - 265-6100 . Reservation card in next GAZETTE.

LADIES PROGRAM:
Historic tours planned. Huge shopping mall nearby. Possible trip to Philadelphia Art Museum or Independance Hall area. Sign up at Registration Desk.

See the next GAZETTE for more details or phone Bill Denk, 81 Steeplechase Rd., Devon, Pa. 19333

BACK ISSUES

The Horn Speaker

All 10 back issues for 1973...$8.00
Single issues...$1.00 each
All 10 back issues for 1974...$6.00
Single issues...$.75 each
All 10 back issues for 1975...$5.00
Single issues...$.75 each
All 10 back issues for 1976...$5.00
Single issue...$.75 each
All 10 back issues for 1977...$5.00
Single issue...$.75 each
Any single issue of 1978 ..$.75 each

The Horn Speaker

Box 12 Kleberg, Texas 75145

Rates for THE HORN SPEAKER
One year.....$5.50
Two years.....11.00
Special rates for one year (mailed in envelope)
First class.....$8.50
Air mail.....12.00
Foreign air mail...16.00
Mail address: THE HORN SPEAKER
Box 12
Kleberg TX 75145

MART

Classified ad rate: 6¢ per word.
Photo ads: $2.00 extra.

Deadline: 20th of the preceding month.

MISC.

"RADIO AGE," a radio magazine devoted to wireless and early broadcast eras. Contains interesting articles written by collectors, articles published in early radio magazines, lots of reprints of famous radio ads, and a classified section for buying or selling radio and electronic items. Subscribe at $7.50 per year for ten issues. Mail check or money order to Radio Age, 1220 Meigs St., Augusta, Georgia 30904.

FOR SALE OR TRADE

FOR SALE: Over 3000 radio magazines from 1913 to 1945, RADIO NEWS, RADIO, RADIO TOPICS, PACIFIC RADIO NEWS, POPULAR RADIO, WIRELESS AGE, RADIO WORLD, QST, ELECT EXPER., plus more. Radio service manuals: RCA, AK, RIDERS, SUPREME, plus more. Write for list R-4-78 75¢ plus SASE w/2 13¢ stamps.
Krantz, 100 Osage Ave., Somerdale N.J. 08083.

FOR SALE OR TRADE

AVAILABLE RADIOS: 1925? Alhambra - Victor #798 Windup Phonograph with Radiola #20 Battery set nice clean combination. 1927? Victor VE10-50X. 4ft. by 4ft. cabinet full doors very elaborate set. Sell or trade. Also R.H. Macy Co. table model early 1930s $50. Emerson table model early 1930s $50. Silvertone wire recorder radio combination table model $75. Zenith 1930s big black dial $85. Call Chuck 503 476-1078 - others.

WD11 and UV99 adaptors. Use any UX base tube $5.50 ea.,pp. USA, 2 for $10.00 either type.
AK brass thumb nuts as used on Breadboards and Mod. 20 sets, 10 for $8.00 pp. K. Parry, 17557 Horace St., Granada Hills CA 91344.

FOR SALE: Rider's Radio Volumes VI through XIV, 9 large manuals, fine condition, only $125. Lawrence Beitman, Box 46, Highland Park IL 60035.

HAVE ANTIQUE RADIO & TV TUBES. Also some antique & old radios. Send 26¢ in stamps for list w/ prices. Harold's Radio, 3106 N. 3rd. St., Harrisburg PA 17110.

BIANK BAKELITE PANELS - Cut to size, 1/16" to 3/8" thick. Fabricating and engraving services available. SASE for pricing sheet. Persons, WB1BVO, 22 Forest St., Branford CT 06405.

NICKEL PLATED brass machine screws, Crosley thumb screws, AK & FE thumb nuts, old tube types and collectables, engraving filler stick, etc. SASE for list. Ray Harland, 2602 Mary Ln., Escondido CA 92025.

FOR SALE:
Stewart Warner Model 310 untouched. Complete with speaker . Balkite 6V battery charger and acid battery Bosch "Nobattery" 115V converter, extra tubes, $275.00.
Atwater Kent Model 60, $150.00.
Address replies to; Jon Z. White, 1408 Dante St., New Orleans LA 70118.

REPLACE those tattered battery cables with fresh cable. We have in stock 10-conductor cable in brown cloth knitted sheath. Use number of conductors as necessary and cut off the rest. Price is $1. per foot plus shipping. Order from: Olde Tyme Radio Co., 2445 Lyttonsville Rd., Silver Spring MD 20910.

FOR SAIE: Tubes for older radios, brand new in original factory boxes. Very reasonable. Send us your list of requirements for a quotation. Daniel Gaidosz, 342 West River Rd., Orange CT 06477.

AK Bread Board switches $10.00 each pp. USA.
K. Parry, 17557 Horace St., Granada Hills CA 91344.

FOR SALE OR TRADE

FOR SALE OR TRADE: Tubes, just about any type from 1920 to date, new and used reasonable. Thousands of radio parts, transformers and AC set chassis parts, also. Excellent for early AC sets, 4 mfd at 600VDC metal sealed paper $3.00 each. Repair and type set, E.H. Scott and classics our specialty. Send SASE with needs. Golden Age Radio Shop, 2222 S. Kinnickinnic Ave., Milwaukee, WI 53207. Phone: 414 744-8825.

FOR SALE: Selling Sams Photofacts 1-550 in Binders; also other Sams. Rider's Radio, Television manuals singly or sets. Early factory service manuals. Lawrence Beitman, Box 46, Highland Park IL 60035.

RECORD COLLECTOR HAS THOUSANDS ON TAPE from 1925 to the 1950's with only dance, swing, novelty bands, C/W and comedy. Want to exchange tapes with anyone who has this kind of music. Will answer all. Sid Rosen, Box 181, Toronto 19 Canada.

FOR SALE: Battery radios for the new collector. SASE for list. Make offer. WZGHE, 45 Allen Dr., Woodstock NY 12498.

FOR SALE OR TRADE: TUBES
Have several hundred tubes for sale. Old and new types for radio and TV. Used and new, cheap. SASE for list. Bruce Harbeck, 1316-38th St., Sioux City, Iowa 51104.

WILL PAY $100 plus postage for factory wired Atwater Kent "Breadboard" in restorable condition. Parsons, 22 Forest, Branford CT 06405.

NOW AVAILABLE: New exact replacement tube bases to use 864, 30, 1LE3 or 1H5GT in WD-11 socket. Send a long SASE for brochure. James Fred, Route 1, Cutler IN 46920.

SASE for list, Marconi, DeForest, Mignon etc. Glenn S. Streeter, 4133 Via Nivel
Palos Verdes Estates CA 90274.

SWAP: Model Q Graphophone for Amborola or good battery radio. Richard Elskamp, 146 River Rd., Marstons Mills MA 02648.

AK Breadboard switches $10.00 each pp. USA.
K. Parry, 17557 Horace St., Granada Hills CA 91344.

WANTED

WANTED: Columbia Vival Tonal Phonograph. Also need left door of Victor Credenza Phonograph, size is 14-1/2 inches wide by 33-3/4 inches high, any condition. Also want to correspond with anyone owning Victor Orthophonic Phonograph VE8-60E. Mechanical information needed. Bob Scott, Box 1694, Wayne New Jersey 07470. Tel: 201 696-1278.

WANTED

WANTED: To correspond with anyone owning Victor Orthophonic Phonograph model VE8-60E. Mechanical and electrical information needed for restoration. Also need left door of Victor Credenza X phonograph. Size is 14-1/2 inches wide by 33-3/4 inches high. Any condition. Bob Scott, Box 1694, Wayne N.J. 07470. Phone; 201 696-1278.

WANTED: RCA 104 or 105 Speaker must be complete and case in restorable condition. RCA Theremin and condition, and would like to communicate with any one who owned one. Ralph G. Maddox, Purgitsville W. VA 26852.

WANTED: Outside horn acoustic phonographs, disc and cylinder records, parts, accessories, paper items, catalogs and advertising. MOST WANTED PARTS: For Edison "Suitcase" Standard; automatic reproducer, record shaver, original horn, crank. For Berliner "Trademark"; arm rest, original reproducer, crank. Edisonic reproducer. Columbia black or nickel plated screw in horn 17½" long, 21¼" across bell. John Hoffman, 649 Washington Ave., Bremerton WA 98310.

WANTED: RADIO NEWS 1920 need all but Jan., 1922, Sept., 1923, Feb., 1936, July, Oct. Dec. 1937 Jan. Thru June. Also have oldies to trade. L.P. Rayner, 5512 N71st Place, Scottsdale AZ 85251.

WANTED: RCA Radiola V, in good physical condition. I will buy outright, or trade my electronical know-how ability towards two of your prize radios. Joseph Woychowski, P.O. Box 254, East Lyme CT 06333.

WANTED: Atwater Kent speakers type-E, type-H, Baldwin 14" horn, three dials for Freshman Masterpiece. D'Arcy Brownrigg, Chelsea, Quebec JOX 1NO Canada.

WANTED: AK Cathedral, preferably model 84. Also would like Philco Cathedrals 20B and 90B. Will buy or trade for. Charles Green, 3309-24th., Great Bend KS 67530.

WANTED: Early AC sets using Kellogg, McCullough, Cardon or Marathon tubes. Also early suitecase type portables (pre-1935). M. Rosenthal, 507 S. Maryland Ave., Wilm., DE 19804.

WANTED: 1933 Emerson Mickey Mouse Radio, preferably working. Brass base BA and BH Raytheon Rectifiers, Meyers RAC-3, deForest Isolantite base tubes. Bob Reidmuller, 4194 Marvin, Oceanside CA 92054.

WANTED: WIRE RECORDERS: Brush, Armour, Telegraphone or oddball types. H. Layer, AV-SFSU, 1600 Holloway, San Francisco CA 94132.

WANTED: Kennedy, deForest and Marconi sets. Trade or buy. Steve Lange, Waldo WI 53093. (414) 541-4811.

WANTED

ZENITH ZEPHYR
(page 191 Vintage Radio)

End-Table Radio Receiver

Three-band super in end-table cabinet

Available in six and ten-tube super models, this modern end-table receiver is built for domestic broadcasts, short-wave and foreign reception. Placed alongside an arm chair, divan or day bed it is convenient to tune. A plate-glass panel protects the dial and slides out of sight when set is in operation. A hinged top covers a utility compartment in the rear which provides storage space for your log and magazines. Provision has been made for an all-wave doublet antenna connection and the set may be used with hard-of-hearing aid if desired.

please write condition & price:

J.W.F. Puett
ANTIQUARIAN COLLECTOR
P. O. BOX 28572 DALLAS, TEXAS 75228
PHONE FROM 9:00 A.M. TO 10:00 P.M. C.S.T.
(214) 321-0927 OR 327-8721
INTERESTED IN PURCHASING
ANTIQUE RADIOS, CAMERAS, WRIST AND POCKET WATCHES, ELECTRIC AND MECHANICAL CLOCKS, FOUNTAIN PENS

WANTED

WOOD HORNS WANTED: Large Bell ONLY (any condition). Phonograph Items Wanted: All parts, advertising items (needle boxes, signs, brochures, counter displays, etc.). Thank you, Jerry Madsen, 4624 W. Woodland Rd., Edina MN 55424.

WANTED: Kennedy, DeForest and Marconi sets. Trade or buy. Steve Lange, Waldo WI 53093. (414) 541-4811.

WANTED: RCA service notes. Volumes 1923-1928, 1929-1930, 1931-1932 and 1938. J. A. Call, 1876 E. 2990 So., Salt Lake City,

WANTED: Scott Philharmonic, also Radiola VIII Super console. Mark Mathison, 103 S. Park, Medford, Wisc. 54451.

WANTED: Always buying old car radios, literature and parts, please price and describe. Marv Roth, 14500 LaBelle, Oak Park, Michigan 48237.

PUETT ELECTRONICS PUETT ELECTRONICS PUETT ELECTRONICS PUETT ELECTRONICS PUETT ELECTRONICS

PUETT ELECTRONICS

P.O. BOX 28572 DALLAS TEXAS 75228
PUBLISHERS OF
THE CLASSIC RADIO NEWSLETTER

(send 13¢ stamp for newsletter sample)

SCHEMATIC DIAGRAMS
WE CAN FURNISH SCHEMATICS ON ANY RADIO (1920 to 1954) - $1.50 postpaid. IF YOU CAN NOT FURNISH THE NAME OF THE MANUFACTURER AND THE MODEL NUMBER, SEND THE TYPES AND QUANTITY OF TUBES AND WE WILL RESEARCH OUR FILES FOR A SIMILAR SET WHICH USES THE SAME TUBES - RESEARCH $3.00 postpaid.

NEW ACQUISITIONS LIST
01A, 99, WD-11, etc. when in stock, ANTIQUE RADIO SETS AND TEST GEAR, ANTIQUE RADIO BOOKS, AND OTHER "one at a time" items-- list sent by first class mail four to six times a year by subscription -- $2.00 per year.

BALLAST TUBES send for catalog.

THE PUETT ELECTRONICS SUPER ANTENNA - GROUND SYSTEM plans $2.

PUETT ELECTRONICS **LISTS - BOOKS & BOOKLETS** (postpaid)
(1) THE ACQUISITION OF ANTIQUE RADIOS by J. W. F. Puett $2.00
(2) THE COMPLETE RESTORATION OF BATTERY POWERED ANTIQUE RADIOS by J. W. F. Puett $2.00
(3) THE COMPLETE RESTORATION OF AC POWERED ANTIQUE RADIOS by J. W. F. Puett $2.00
(4) COMPLETE LIST OF ANTIQUE RADIO SERVICES $2.00 (new list)
(5) WHEN WAS THAT OLD TUBE MADE? by James R. Wilkins $2.00
(6) SILVER GHOSTS by J. W. F. Puett - classic sets by E. H. Scott $10.00
(7) MILITARY TUBE TYPE (VT) TO COMMERCIAL TUBE TYPE CROSS-REFERENCE LIST $1.00

HOW TO ORDER — List No. 17

(1) Make checks and money orders payable to PUETT ELECTRONICS.
(2) WE SHIP PARCEL POST. NO C.O.D. INCLUDE 15% FOR POSTAGE & HANDLING. POSTAL INSURANCE RATES ARE 60¢ FOR ORDERS UP TO FIFTY DOLLARS. MINIMUM ORDER $3.00 - DOES NOT APPLY TO SCHEMATIC DIAGRAMS OR BOOKLETS. ORDERS WHICH EXCEED $50.00 ARE SHIPPED POSTPAID. TEXAS RESIDENTS ADD 5% STATE SALES TAX.

POLICY

CUSTOMER SATISFACTION GUARANTEED. If you are not satisfied with your order for any reason, tubes may be returned within ten days for refund or replacement with exception of tubes which are shorted or have open filaments. It will be assumed that returned tubes with open filaments or shorts were damaged in shipment. Shipping damage claims will be handled promptly through the post office on insured orders. PUETT ELECTRONICS assumes no liability for orders which are not insured, and no liability beyond that which is covered by postal insurance. The tubes listed herein are either new, military pull-outs, factory over-purchases, or used. If only new tubes in original cartons are acceptable, add 10% to the total cost of your tube order. REFUNDS are mailed with your invoice for out-of-stock merchandise. ALL TUBES ARE THOROUGHLY TESTED ON A MUTUAL CONDUCTANCE TUBE CHECKER BEFORE SHIPMENT. ALL TUBES MUST MEET NEW TUBE STANDARDS WHEN CHECKED. All prices are subject to change without notice. All tube prices listed herein supersede prices in previous lists and ads. We offer free technical advice for a 13¢ stamp or you may call J. W. F. Puett NO LATER THAN 10:00 PM CENTRAL STANDARD TIME - PLEASE.

ANTIQUE RADIO TUBES

PUETT ELECTRONICS HAS HUNDREDS OF OTHER TUBE TYPES NOT LISTED HEREIN. FOR OTHER TUBE TYPES, SEND 65¢ FOR CATALOG.

0D3	$2	1G4	$4	1T5	$3	5Y4	$3	6C5	$3	6R7	$4	7B5	$3	12K7	$4
0Z4	$3	1G5	$4	1U4	$3	5Z3	$3	6C6	$4	6S4	$4	7B6	$4	12K8	$4
1A1	$5	1G6	$4	1U5	$3	6A3	$5	6C7	$4	6S8	$4	7B7	$4	12L6	$2
1A3	$4	1H4	$5	1V	$5	6A4	$6	6C8	$4	6SA7	$3	7B8	$4	12Q7	$4
1A4	$4	1H6	$4	2A3	$7	6A5	$4	6D6	$4	6SB7	$3	7C5	$3	12S8	$3
1A5	$4	1J6	$8	2A5	$4	6A6	$4	6D7	$4	6SC7	$3	7C6	$4	12SA7	$3
1A6	$3	1LA4	$4	2A6	$4	6A7	$5	6D8	$4	6SD7	$3	7C7	$4	12SC7	$3
1A7	$3	1LA6	$4	2B7	$4	6A8	$4	6E5	$5	6SF5	$3	7E6	$4	12SF5	$3
1B4	$4	1LB4	$4	2E5	$5	6AB4	$3	6E6	$4	6SF7	$3	7E7	$4	12SF7	$3
1B5	$4	1LC5	$5	2X2	$3	6AB7	$3	6E7	$4	6SG7	$4	7F8	$5	12SG7	$3
1B7	$4	1LC6	$4	3A4	$3	6AC5	$3	6F5	$4	6SH7	$3	7G7	$4	12SH7	$3
1B8	$4	1LD5	$4	3A5	$3	6AC7	$3	6F6	$4	6SJ7	$3	7H7	$4	12SJ7	$3
1C1	$4	1LE3	$4	3A8	$4	6AK5	$2	6F7	$6	6SK7	$3	7J7	$4	12SK7	$3
1C5	$3	1LF3	$4	3C6	$4	6AL5	$3	6F8	$4	6SL7	$3	7L7	$4	12SL7	$3
1C6	$3	1LG5	$4	3LF4	$5	6AL7	$5	6G5	$5	6SN7	$2	7Q7	$4	12SN7	$3
1C7	$5	1LH4	$4	3Q5	$3	6AQ5	$2	6G6	$3	6SQ7	$3	7R7	$4	12SQ7	$3
1D5	$5	1LN5	$4	3V4	$3	6AT6	$2	6H6	$2	6SR7	$3	7S7	$4	12SR7	$3
1D7	$5	1N5	$4	5AZ4	$5	6AU6	$2	6J5	$3	6SS7	$3	7V7	$4	12V6	$4
1E5	$5	1N6	$4	5R4	$2	6AV6	$2	6J6	$2	6ST7	$3	7W7	$4	12X4	$2
1E7	$4	1P5	$4	5T4	$2	6AX5	$2	6J7	$4	6SU7	$3	7X6	$4	12Z3	$2
1F4	$4	1Q5	$4	5U4	$2	6B4	$5	6K5	$3	6SV7	$3	7X7	$4	14A4	$4
1F5	$4	1R5	$2	5V4	$2	6B5	$5	6K6	$3	6T7	$4	7Y4	$4	14A5	$4
1F6	$4	1S5	$2	5W4	$2	6B6	$5	6K7	$4	6U5	$5	7Z4	$3	14A7	$4
1F7	$5	1T4	$3	5X4	$3	6B7	$5	6K8	$4	6U7	$5	10	$7	14B5	$3
				5Y3	$3	6B8	$4	6L5	$4	6V6	$2	12A5	$4	14B6	$4
						6BA6	$2	6L6	$3	6V7	$4	12A6	$4	14B8	$4
						6BE6	$3	6L7	$4	6X4	$2	12A7	$4	14C5	$3
						6BJ6	$2	6N5	$5	6X5	$2	12A8	$4	14C7	$4
						6C4	$2	6N6	$4	6Y5	$3	12AH7	$3	14E6	$4
								6N7	$4	6Z4	$3	12AT6	$2	14E7	$4
								6Q7	$4	7A4	$4	12AT7	$2	14F7	$4
										7A5	$3	12AU6	$2	14F8	$4
										7A6	$4	12AU7	$2	14H7	$4
										7A7	$4	12AV6	$2	14J7	$4
										7A8	$4	12AX7	$2	14N7	$4
										7AE7	$4	12BA6	$2	14Q7	$4
										7AG7	$4	12BE6	$2	14R7	$4
										7B4	$4	12J5	$3	14W7	$4
												12J7	$4	14X7	$4
														15	$7
														19	$4
														22	$7
														24A	$5
														25A6	$3
														25A7	$3
														25AC5	$3
														25B6	$3
														25C6	$2
														25L6	$3
														25S	$4
														25Z5	$3
														25Z6	$3
														26	$6
														26A6	$4
														26A7	$4
														27	$4
														28D7	$3
														30	$5
														31	$4
														32	$4
														33	$4
														34	$4
														35	$4
														35A5	$4
														35B5	$2
														35C5	$2
														35L6	$3
														35W4	$2
														35Y4	$4
														35Z3	$4
														35Z4	$4
														35Z5	$3
														35Z6	$4
														36	$4
														37	$4
														38	$3
														39	$3
														40	$7
														41	$4
														42	$4
														43	$4
														44	$3
														45	$6
														47	$7
														48	$4
														49	$4
														50	$7
														50A5	$3
														50B5	$2
														50C5	$2
														50C6	$4
														50L6	$3
														50X6	$4
														50Y7	$4
														51	$4
														55	$5
														56	$3
														57	$4
														58	$4
														59	$6
														70A7	$3
														70L7	$5
														71A	$7
														75	$4
														76	$3
														77	$4
														78	$4
														79	$4
														80	$3
														81	$6
														82	$3
														83	$3
														83V	$3
														84	$3
														85	$4
														89	$4
														117L7	$5
														117M7	$5
														117N7	$7
														117P7	$7
														117Z3	$3
														117Z4	$4
														117Z6	$4
														485	$5
														884	$7
														950	$5
														951	$5
														955	$4
														958	$4
														1201	$4
														1203	$4
														1232	$4
														1273	$4
														1852	$3
														1853	$3
														9002	$3
														9003	$3
														9004	$4
														VR-90	$2
														VR-105	$2
														VR-150	$2
														VT-52	$5
														FM1000	$4
														XXB	$4
														XXL	$4
														XXFM	$4

FOR Tops in Performance

REPLACE WEAK OR DEAD TUBES IN YOUR RADIO

NEW! JUST OUT!! ANTIQUE RADIO CATALOG - 8 PAGES

65¢ or five 13¢ STAMPS

EVERYTHING FOR ANTIQUE RADIO RESTORATION
TUBES - SCHEMATIC DIAGRAMS - RADIO BOOKLETS

CAPACITORS - RESISTORS - INTERSTAGE & POWER TRANSFORMERS, SPEAKERS, CHOKES, DIAL LAMPS, RF COILS, I.F. TRANSFORMERS, SWITCHES, VOLUME CONTROLS, DRIVE BELTS, TUBE SOCKETS & ADAPTORS, HOOK-UP WIRE, DIAL LAMPS, BATTERIES, METERS, ETC.

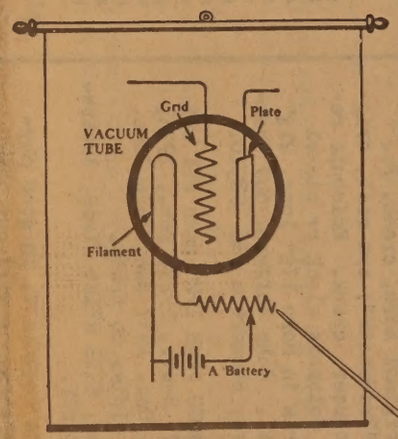
PUETT ELECTRONICS
P.O. BOX 28572 DALLAS TEXAS 75228
PUBLISHERS OF
THE CLASSIC RADIO NEWSLETTER

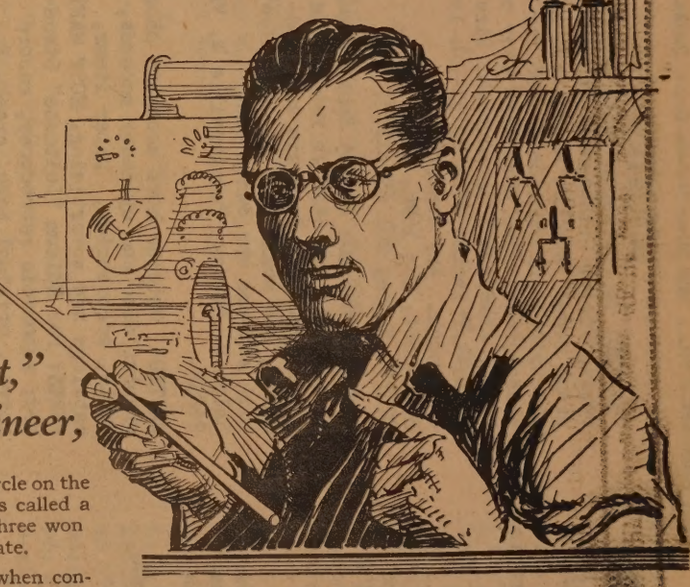
PUETT ELECTRONICS PUETT ELECTRONICS PUETT ELECTRONICS PUETT ELECTRONICS PUETT ELECTRONICS

MAY 75c

THE HORN SPEAKER

1978





"This is the vital part," says the radio engineer,

"of the receiving set. The heavy circle on the chart is the audion bulb, sometimes called a detector or vacuum tube. It has three wonderful parts—filament, grid, and plate.

"The filament becomes white hot when connected to the "A" battery, and sends out a fairy rain of invisible, electrified particles, which pass through the grid and strike the plate just as a spring rain is driven through the bare twigs of a hedge fence.

"The telephone receivers detect the slightest variation in the rain upon the plate. The broadcasting waves run from the antenna to the grid and interfere with the fairy rain like the leaves on a hedge interfere with a summer shower. So you see, by interfering with the fairy rain, the broadcasting waves make the telephones sing and talk.

"Since it is the fairy rain from the filament which does the trick, it is all-important that you provide noiseless, stepless, and extremely accurate control of filament current. The success of your set will depend upon the quality of your filament rheostat."

1922

the audion bulb

Mr. Art B. Corbus
4501 Greenwood Ave. N., #105
Seattle WA 98103

7